THE IMPROVEMENT OF READING
IN A SCHOOL FOR THE BLIND

STUDIES IN THE RATE OF READING BRAILLE

Monograph Number 10

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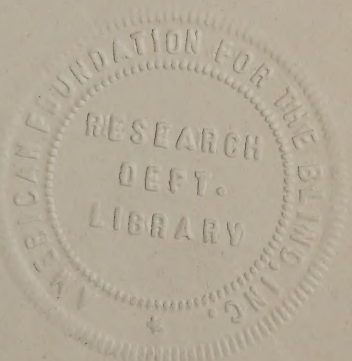*The New York Institute for the Education of the Blind*
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PREFACE

This monograph is the tenth in a series of studies published by The New York Institute for the Education of the Blind.

In this monograph the authors have dealt with the subject of braille reading in a school for the blind, a subject which in the past has had little scientific analysis. There has been much general discussion about a blind child's reading, but few specific studies indicating his rate of reading or his ability to comprehend what he has read, and very little scientific work comparing the blind and the sighted in these respects.

This monograph is one of a series of studies on the improvement of reading in a school for the blind, which studies are being carried on continuously by the staff of this school. Much credit is due Dr. Athearn, Mrs. Campbell and Mr. Lavos for the painstaking analysis presented herewith. We hope that other teachers of the blind and other schools serving blind children may see fit to augment our knowledge of this subject by means of similar studies.

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May, 1944.

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THE IMPROVEMENT OF READING IN A SCHOOL FOR THE BLIND.

Importance of Reading to the Blind Child.

"Carlyle was not far wrong when he said that all any school can do is to teach us how to read." This is the view of an authority on educational measurement. (McCall, How To Measure in Education, page 146.)

Reading is the most important single means of enlightenment to the blind child. This important skill is necessary to his recreation, study, mental hygiene, and intellectual advancement. Reading is a necessary tool for the mastery of nearly every other school subject. Progress in geography, history, and literature, for example, is dependent on good reading habits. Difficulties in arithmetic are often due to inability to read the problems accurately. Schools rightly give a proportionately large share of time and attention to this subject.

Though schools for the blind have long recognized the central necessity of braille reading, we have not yet devoted the amount of time and attention to this subject which its importance warrants. In the field of tests and measurements, Samuel P. Hayes inaugurated the first scientific study of this subject at Overbrook in 1917. (See Hayes, S.P., "Report of Preliminary Tests in Reading," Pennsylvania Institution for the Instruction of the Blind, June 1918.) In the area of methodology, Katherine E. Maxfield brought pedagogical thought to bear on the problems of braille reading in her pioneering volume, *The Blind Child and His Reading* (1928). The problems of braille reading, particularly as they touch the beginner, have received considerable attention from time to time, by such practical workers as Frieda Kiefer Merry, B. F. Holland, Pauline F. Eatman, Emily Ellis, and others.* Nevertheless, the progress which has been made hardly measures up to the standard of achievement which is needed if the teaching of braille reading is to be as efficient as it should be in our schools.

The purpose of this series of monographs is to record the results of the efforts toward the improvement of braille reading at The New York Institute for the Education of the Blind. The earlier monographs

*Merry, Frieda Kiefer, *Suggestions for Motivating Primary Braille Reading*, American Foundation for the Blind.

Holland, B. F., and Eatman, Pauline F., "*The Silent Reading Habits of Blind Children*," *Teacher's Forum* (September, 1933), page 4.

Ellis, Emily, *Outlook for the Blind*.

will contain a survey of the results of tests and measurements, the final chapters, an account of diagnostic and remedial methods.

The Rate of Reading Braille.

At the New York Institute, we have given several types of tests from which data have been drawn as to the rate of reading braille. Among these are:

1. The Stanford School Achievement Tests.
2. The Monroe Silent Reading Tests.
3. The New York State Reading Progress Tests.
4. Informal textbook tests in Braille Grade 1½.
5. Informal tests in the READER'S DIGEST, Braille Grade 2.
6. Informal oral reading tests.

The results of these tests will be presented in the following form:

I. A Study of Central Tendencies.
II. Significant Factors Affecting the Rate of Reading Braille.
III. Tests in the Oral Reading of Braille.
IV. Summary of Studies in the Rate of Reading Braille.

PART I

A STUDY OF CENTRAL TENDENCIES.

1. Informal Textbook Tests.

The method of giving the informal textbook tests may be gathered from the following instructions to teachers.

REMEDIAL WORK IN READING

How fast can your children read?

Are they improving in speed and comprehension?

In order to help children to develop speed in reading, some such method as the following may be found helpful:

1. Preparatory steps.

    a. Selection of reading material within the abilities of pupils, but not too easy.

    b. Let the children know that they are reading to improve their speed, but that they will also be expected to under-stand the thought of the selection.

    c. Be sure the children understand what they are to do, and that they begin and stop the instant they hear the command.

2. Time each pupil.

    At the end of a given time, say five or ten minutes, stop the class, have them note the last word and count back to the first. Then tell them how many minutes they have read, and let them divide to get their score. The teacher may estimate the number of words in a line and count the number of lines on the page, thus computing a fairly accurate total.

3. Comprehension questions.

    Questions to test the understanding of the selection should follow the reading. The teacher may use her usual methods of testing and grading.

    The true-false and the yes-no questions are easiest to correct.

4. Special remedial work.

    The suggested group remedial work should produce improve-ment and help pupils who might otherwise need individual

attention. For the pupils who are still low in reading the teacher should make use of the "Gray Oral Reading Tests." These tests analyse the reading process and help locate pupil difficulties. Copies of these tests, in Braille, are in our library. Tentative standards for pupils without sight may be found in Maxfield, "The Blind Child and His Reading," page 161.

5. Report results.

Accurate reports will help in determining what standards of reading we should set for our pupils. A record of the results of the first trial should be kept, and then, after this procedure has been repeated from time to time, the pupil should be carefully tested again, and the final trial should be recorded. Comparison of this final result with the first trial will show whether this method has resulted in improvement.

READING SPEED AND COMPREHENSION

Grade..:......Teacher...

Textbook..

Pupil	No. Pages 5 or 10 Minutes	Words per Minute	Comprehension Per Cent Correct

NOTE: Have pupils compute the number of words per minute, by counting the number of words in a line and the number of lines on a page. Test comprehension by ten true-false or multiple choice questions based on the selection, and recording number correct. Repeat this procedure from time to time to encourage pupils to improve their reading record.

COMPREHENSION TESTS
MARCH AND APRIL 1938.

1. The following table shows the results of the preliminary tests:

TABLE 1

READING RATE IN WORDS PER MINUTE
IN SCHOOL READERS.

Measures	Fourth Grade Reader	Fifth Grade Reader	Sixth Grade Reader	Seventh Grade Geography	Eighth Grade Civics
Median	75	76.5	100.5	84.5	81
Q1	64	57.5	86.5	81	75
Q3	78	152	108.5	90	75
Lowest	51	39	66	56	50
Highest	105	176	126	127	120

2. There seems to be little correlation between reading speed and comprehension. This might mean either poor classification or poor teaching as to individual needs. Teachers should emphasize reading for understanding in the case of pupils reading at above average speed. Some pupils having a high comprehension grade at a low rate of reading should be speeded up.

3. Tests of this kind should be repeated more frequently:
    A. As a teaching device to interest pupils in their own progress.
    B. As an administrative measure, to build up reading standards for the various grades.

4. If teachers who give these tests will keep records, and report results, it will help this school to make a contribution toward raising standards of braille reading.

5. The New York State Preliminary Regents examinations in reading afford an excellent medium, already in braille, for testing reading speed as well as comprehension, especially in the middle grades.

6. Study hall proctors are urged to use this method, keeping records of pages read during a study period; or during a shorter period of time. This should stimulate attention and concentration during study.

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SUMMARIES OF READING TESTS 1939-40

The following summaries of reading tests show the average speeds of ·reading Braille 1½ for each school grade. The average number of pages read in a thirty-minute study period is also given. These figures are not intended to set standards for any grade, because the rate for each grade will be modified by the number of years the pupils have read Braille on the average before entering the grade. Nevertheless, these records should be of help to teachers in judging what they should require as to length of assignments, reading speed, etc.

Tables 2, 3 and 4 show the results of tests using textbook materials. Table 5 summarizes in addition, the results of the Monroe Silent Reading Tests, the Stanford Achievement Tests, and the New York Reading Progress Tests. Table 5, column 3, page 11, may be interpreted as follows:

In 190 bona fide cases the range of reading speed was from 10 to 198 words per minute. The mean (or arithmetic average) rate was 81.28. From the Standard Deviation of 3.59 we know that 68 per cent of the cases lie between 77.7 and 84.9 words per minute; and 95 per cent of the cases, between 74.1 and 88.5 words per minute.

The Standard Error of the Mean, 0.26, indicates that in situations of which this test is a representative sampling, i.e. in schools for the blind including grades 1-12 and an age range of 8-20 years, the chances are 68 in 100 that the true mean will lie between 81.02 and 81.54; the chances are 95 in 100 that the true mean will lie between 80.74 and 81.82; and the chances are 99.7 in 100 that the true mean will lie between 80.5 and 82.06.

As an illustration of the statistical methods used, Table 6, page 12, is given to show the calculation of the mean (m), the Standard Deviation (SD), and the Standard Error of the Mean (SEm).

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TABLE 2
SUMMARY OF BRAILLE READING TESTS, 1939-40

School Grade	Words per Minute	Pages in 30 Min.	Per Cent Correct	Monroe Test 1937-38	School Readers 1938-39
2nd					
Lowest	24		60		
Median	28.5		90		
Highest	78		100		
3rd					
Lowest	10		60		
Median	55		72.5		
Highest	111		80		
4th					
Lowest	38		65		51
Median	57		80	32	75
Highest	88		90		105
5th					
Lowest	12	3	30		39
Median	45.5	9	63	35.5	76.5
Highest	80	18	95		176
6th					
Lowest	15	2.5	51		66
Median	71	10	87	56	100.5
Highest	120	27	97		126
7th					
Lowest	20	3	30		56
Median	83	11.3	60	74.5	84.5
Highest	198	24	90		127
8th					
Lowest	20	3	50		50
Median	66	10.9	80	67.5	81
Highest	136	18.7	100		120
9th					
Lowest	48	7.5	50		
Median	63	10.5	65	37	
Highest	109	22.5	90		
10th					
Lowest	41	6	30		
Median	90	15	78	37	
Highest	197	24	99		
11th					
Lowest	40	9	21		
Median	96	13.5	82	31	
Highest	195	18	100		
12th					
Lowest	35	10	35		
Median	71	15	78	37	
Highest	176	21	100		

TABLE 3

SUMMARY OF BRAILLE 1½ READING SPEED

ENTIRE SCHOOL

ALL TEXTBOOK READING MATERIALS

Words per Minute	Number of Pupils	Words per Minute	Number of Pupils
0- 4	0	100-104	5
5- 9	0	105-109	5
10- 14	2	110-114	4
15- 19	1	115-119	2
20- 24	6	120-124	7
25- 29	2	125-129	3
30- 34	0	130-134	3
35- 39	11	135-139	1
40- 44	10	140-144	2
45- 49	8	145-149	1
50- 54	13	150-154	2
55- 59	10	155-159	0
60- 64	13	160-164	2
65- 69	7	165-169	0
70- 74	12	170-174	2
75- 79	7	175-179	1
80- 84	5	180-184	0
85- 89	6	185-189	0
90- 94	3	190-194	1
95- 99	5	195-199	4

Lowest	10
Q_1	38.5
Median	70
Q_3	126.5
Highest	198

TABLE 4

SUMMARY OF NUMBER OF PAGES READ
IN THIRTY MINUTES
GRADES 5-12
ALL TEXTBOOK MATERIALS, BRAILLE 1½

Pages	Pupils
0- 4	9
5- 9	38
10-14	37
15-19	33
20-24	13
25-29	1
30-34	0
35-39	1
40-44	0
45-49	0
50-59	2

Lowest	3
Q_1	8
Median	12.7
Q_3	17.5
Highest	56

TABLE 5

RATE OF READING BRAILLE 1½*

SEVERAL TESTS COMPARED AS TO
CENTRAL TENDENCIES

MEASURES	(1) Monroe Silent Reading	(2) Stanford Form Z	(3) School Textbooks	(4) Stanford Form V	(5) New York Progress	(6) All Tests
School Grades	4-12	4-9	2-12	4-9	4-6	2-12
Age Range	11-20	10-20	8-20	10-20	9-16	8-20
Number of Cases	115	74	190	72	31	482
Reading Range Words per Minute	12-91	8-40	10-198	8-40	21-62	8-198
Mean Words per Minute	45.4	31.0	81.28	28.8	41.07	50.68
Standard Deviation	2.93	2.62	3.59	2.95	2.53	3.19
Standard Error of the Mean	0.273	0.305	0.26	0.354	0.45	0.146

*In all cases except Column 3, the mean includes the time taken to record answers to test questions.

TABLE 6

RATE OF READING BRAILLE IN SCHOOL TEXTBOOKS
CALCULATION OF MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN

Intervals —Scores	Midpoint	f	x'	fx'		fx^2
1- 10	5.5	1	— 7	— 7		49
11- 20	15.5	4	6	24		144
21- 30	25.5	6	5	30		150
31- 40	35.5	13	4	52		208
41- 50	45.5	15	3	45		135
51- 60	55.5	25	2	50		100
61- 70	65.5	21	— 1	—21	(—229)	21
71- 80	75.5	22	0	0		
81- 90	85.5	18	+ 1	+18		18
91-100	95.5	13	2	26		52
101-110	105.5	12	3	36		108
111-120	115.5	11	4	44		176
121-130	125.5	9	5	45		225
131-140	135.5	3	6	18		108
141-150	145.5	4	7	28		196
151-160	155.5	4	8	32		256
161-170	165.5	2	9	18		162
171-180	175.5	5	10	50		500
181-190	185.5	0	11	0		0
191-200	195.5	2	+12	+24	(+339)	288
		190			—229	2896
					+110	

Assumed
Mean = 75.5
      5.78
Mean = 81.28

Correction: c

$$c = \frac{110}{190} = 0.578 \times 10 = 5.78$$

$$SD = \sqrt{\frac{\Sigma fx'^2}{N} - c^2} \times i \ = \sqrt{\frac{2896}{190} - 2.34} = \sqrt{15.24 - 2.34} = \sqrt{12.90} = 3.59$$

$$SEm = \frac{SD}{\sqrt{n}} = \frac{3.59}{\sqrt{190}} = \frac{3.59}{13.784} = 0.26$$

2. Monroe Silent Reading Tests.

The results of the Monroe Silent Reading Test are given in Table 5, Column 1, Page 11. The mean average number of words per minute was 45.4, with a standard deviation of 2.93, and standard error of the mean of 0.273. In this distribution, 68% of the cases lie between 42.47 and 48.33 words per minute. In tests in other schools for the blind, in grades 4-12, with pupils between the ages of 12 and 20, the chances are 68 in 100, that the mean rate of reading Braille 1½ will be found to lie between 45.13 and 45.67; the chances are 95 in 100, that the true mean will be found to lie between 44.85 and 45.95; and 99.7 in 100 that it will lie between 44.58 and 46.22.

The calculations follow, by way of illustration of the statistical procedures used:—

TABLE 7

MONROE SILENT READING TESTS, BRAILLE 1½
CALCULATION OF MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN

Scores Interval	f		x'		fx²	
1- 10						
11- 20	6	15.5	2	12	72	+143
21- 30	17	25.5	1	17	289	— 29
31- 40	32	35.5	0	(—29)	0	c = 114 = .99
41- 50	20	45.5	—1	+20	400	
51- 60	16	55.5	—2	+32	512	115
61- 70	10	65.5	—3	+30	300	i = 10.
71- 80	10	75.5	—4	+40	400	ci = + .99 x 10 = +9.9
81- 90	3	85.5	—5	+15	45	
91-100	1	95.5	—6	+ 6	6	
	115			(+143)	2024	

AM 35.5
+ 9.9

Mean 45.4

$$SD = \sqrt{\frac{2024}{115} - (.9)^2} \times 10 = \sqrt{17.6 - 9} = \sqrt{8.6} = 2.93$$

$$SEm = \frac{SD}{\sqrt{n}} = \frac{2.93}{\sqrt{115}} = \frac{2.93}{10.724} = 0.273$$

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3. New York Reading Progress Tests.

When the New York Reading Progress Tests were given, record was kept of the number of words read during the first hour of the test. During this time pupils were also writing the answers to the comprehension questions on each selection.

This test for Grades 4, 5 and 6 consists of six short stories in Braille 1½. Each story is accompanied by five comprehension questions.

The writing of from 15 to 45 answers, though each answer is only a word, takes some time from the actual reading. This should be borne in mind in considering the final scores, that the results include the time consumed in writing the answers, as well as in reading the selections.

The Monroe Silent Reading Tests were also interrupted by written answers so that the results on this test are more comparable to the New York Reading Progress Tests. For Grades 4-6 the median words per minute on the Monroe Test was 41.2; for the New York Test, 40.5.

On straight reading tests from school readers and textbooks, pupils in Grades 4-6 have averaged from 58 to 84 words per minute, with an inclusive range from 12 to 176 words per minute. The range for the Monroe Test was 19 to 58; for the New York Progress Test 22.7 to 61.6 words per minute.

The results of the New York Reading Progress Tests are shown in Table 5, column 5, page 11. Here we find the mean to be 41.07 words per minute. The standard deviation of 2.53 tells us that 68 per cent of the cases lie between 38.54 and 43.6; and 95 per cent, between 37.0 and 46.13 words per minute. The standard error of the mean is only 0.454, indicating that in school situations for which this data can be considered a representative sampling, the chances are 68 in 100 that the true mean will fall between 40.61 and 41.52; the chances are 95 in 100 that the true mean will fall between 40.16 and 41.97; and the chances are 99.7 in 100 that the true mean will fall between 39.70 and 42.43. The computations are shown in Table 10, page 16.

TABLE 8

**SPEED OF READING BRAILLE 1½ ON THE
NEW YORK READING PROGRESS TEST, PART I**

(Grades 4, 5, and 6)

Grade	Words per Hour Range	Words per Hour Median
IV	1389 - 1607	1478
V	1360 - 2157	2842
VI	1260 - 2157	2550
All	1260 - 2157	2430

TABLE 9

**STANDARD TESTS COMPARED WITH TEXTBOOK TESTS
WORDS PER MINUTE IN BRAILLE 1½**

Grade	New York Reading Progress Test Range (1941)	Median (1941)	Testbook Tests (1940)	(1939)	Monroe Test (1938)
IV	23.2 - 26.8	24.7	57.0	75.0	32.0
V	22.7 - 61.6	47.1	45.5	76.5	35.5
VI	21.0 - 61.6	42.5	71.0	100.5	56.0
All	22.7 - 61.6	40.5	57.8	84.0	41.2

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TABLE 10

NEW YORK READING PROGRESS TEST
GRADES 4-6. BRAILLE 1½
CALCULATION OF MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN

Scores Interval	Midpoint	f	x'	fx		fx²
21-25	23	6	—4	—24		96
26-30	28	4	3	12		36
31-35	33	3	2	6		12
36-40	38	2	—1	— 2	(—44)	2
41-45	43	6	0	0		
46-50	48	4	+1	+ 4		4
51-55	53	2	2	4		8
56-60	58	0	3	0		0
61-65	63	4	+4	+16		64
66-70	68	0			(+32)	
	n =	31	—		(—12)	222

AM   43.000

— 1.935

Mean   41.065

$$c = -\frac{12}{31} = -0.387$$

$$i = 5$$

$$ci = 1.935$$

$$SD = \sqrt{\frac{222}{31} - .149769 \times 5} = \sqrt{7.16129} - .748845 = \sqrt{6.412445} = 2.53$$

$$SEm = \frac{2.53}{\sqrt{n}} = \frac{2.53}{5.568} = 0.454$$

4. Stanford Achievement Tests.

In the case of the Stanford Tests, Table 5, columns 2 and 4, page 11, it was found that the results were unreliable. Due to the method of timing, it was impossible to estimate the exact rate of reading for each pupil. Both the Standard Deviations and the Standard Error of the Mean are relatively large. The skewness of the distribution is shown by the fact that from one-fourth to one-third of all the cases pile up in the final interval, 38-40 words per minute, which is the highest reached by any pupil. This result is contrary to the known fact that many of these same pupils have read faster in other tests.

For these reasons, it seems best to drop out the results of the Stanford tests in forming our judgment of the average rate at which blind pupils can read.

5. Central Tendencies of all Braille 1½ Tests.

Omitting the Stanford tests, and recalculating the measures of central tendency for all other Braille 1½ tests, we discover the mean average rate of reading Braille 1½ to be 65.2 words per minute.

The standard deviation of 2.15 indicates that 68% of the cases lie between 63.05 and 67.35 words per minute; 95 per cent, between 60.9 and 69.5 words per minute. (See Table 12, page 19.)

The standard error of the mean was 0.1172. This measure indicates that in other school situations, for which this data may be considered to be representative, the chances are 68 in 100 that the true mean will fall between 65.08 and 65.32; 95 in 100, that it will fall between 64.76 and 65.43; and that it is a practical certainty that the mean average speed of reading braille 1½ will be found to be between 64.85 and 65.85.

TABLE 11

RATE OF READING BRAILLE 1½, RESULTS OF NEW YORK READING PROGRESS TESTS, MONROE SILENT READING TESTS AND TEXTBOOK TESTS

CALCULATION OF MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN

Intervals	f	x	fx	fx²
1- 10	1	— 5	— 6	30
11- 20	10	4	40	160
21- 30	33	3	99	297
31- 40	51	2	102	204
41- 50	44	— 1	— 44	44
51- 60	43	0	(—291)	
61- 70	35	+ 1	35	35
71- 80	32	2	64	128
81- 90	21	3	63	189
91-100	14	4	56	224
101-110	12	5	60	300
111-120	11	6	66	396
121-130	9	7	63	441
131-140	3	8	24	192
141-150	4	9	36	324
151-160	4	10	40	400
161-170	2	11	22	242
171-180	5	12	60	720
181-190	0	13	0	
191-200	2	+14	28	392
	n = 336		(+617)	4718
			—291	
			+326	

$$AM = 55.5$$
$$Correction = + 9.7$$
$$Mean \quad 65.2$$

$$c = \frac{326}{336} = 0.97$$
$$i = 10$$
$$ci = 9.7$$

$$SD = \sqrt{\frac{4718}{336} - 9.409} = \sqrt{4.632} = 2.15$$

$$SEm = \frac{SD}{\sqrt{n}} = \frac{2.149152}{18.33} = 0.1172$$

TABLE 12

RATE OF READING BRAILLE 1½
REVISED TABLES FOR ALL TESTS

MEASURES	NAME OF TEST			
	Monroe Silent Reading	School Textbooks	New York Progress	All Tests
School Grades	4-12	2-12	4-6	2-12
Age Range	11-20	8-20	9-16	8-20
Number of Cases	115	190	31	336
Reading Range Words per Minute	12-91	10-198	21-62	10-198
Mean Words per Minute	45.4	81.28	41.07	65.2
Standard Deviation	2.93	3.59	2.53	2.15
Standard Error of the Mean	0.273	0.26	0.45	0.1172

BRAILLE GRADE 2 RATE OF READING TESTS

In Braille 1, all the words are completely spelled out. Braille 1½ has 44 word abbreviations or contractions. Standard English Braille Grade 2 has 185 contractions, and 74 abbreviated words. Numerous rules covering syllabification and punctuation make Grade 2 more difficult to learn.

In the beginning, Braille 2 appears to be more difficult, but once the contractions are learned its mastery should speed up braille reading; the compactness of Braille 2 means much less space to be traversed by the fingers of the blind reader.

In considering the results of tests in Braille reading it is essential to notice the grade of Braille used. In the case of the New York Reading Progress test for example, the fact that the test for Grades 4-6 was in Braille 1½; and that for Grades 7-9, in Braille 2, should also be borne in mind in considering the results in these grades.

40.5 words per minute was the median in Braille 1½.

28.3 words per minute was the median in Braille 2.

The fastest readers in Braille 1½ achieved 61.6 words per minute. The fastest Braille 2 readers achieved 72.8 words per minute.

TABLE 13

SPEED OF READING STANDARD ENGLISH BRAILLE
NEW YORK READING PROGRESS TEST, FORM A

Grades 7, 8, and 9

Grade	Words in 50 Minutes Range	Words in 50 Minutes Median
VII	796 - 2590	1450
VIII	689 - 2054	1175
IX	946 - 3642	1906
All	689 - 3642	1415

Grade	Words per Minute Range	Words per Minute Median
VII	15.9 - 51.8	29.0
VIII	13.8 - 41.1	23.5
IX	19.0 - 72.8	38.2
All	13.8 - 72.8	28.3

TABLE 14

DISTRIBUTION OF READING SPEEDS
ON THE NEW YORK READING PROGRESS TESTS

Grades 4-6   Braille 1½

Words per Minute	Number of Pupils
20 - 29	10
30 - 39	5
40 - 49	10
50 - 59	2
60 - 69	4
Median 40 . 5	31

Grades 7-9   Braille 2

Words per Minute	Number of Pupils
10 - 19	4
20 - 29	16
30 - 39	7
40 - 49	2
50 - 59	4
60 - 69	0
70 - 79	1
Median 28 . 3	34

Three types of tests in Braille Grade 2 may be compared as to central tendencies.

. The test in school textbooks comprised such a small number of cases as to involve a large standard deviation. With a mean of 72.29, and a standard deviation of 59.14, sixty-eight percent of the cases lie between 13. and 131. words per minute. This is a fair symptom of the unevenness of ability to read Grade 2 as found in a chance sampling of pupils in a school for the blind. The chances are 68 in 100 that in a similar school situation the true mean would fall between 56 and 88 words per minute; the standard error of the mean being 15.8.

The rate on the New York Reading Progress test was slowed down by the fact that the time taken to answer questions was included. Here, the mean was 30.35 words per minute. Sixty-eight percent of the cases fell between 27.85 and 32.85 words per minute; 95 percent between 25.35 and 35.35. With a standard error of the mean of 0.435, in a similar school situation the chances are 68 in 100 that the true mean would fall between 29.9 and 30.78 words per minute; 95 chances in 100, between 29.48 and 31.25; 99.7 chances in 100, between 29. and 31.65.

The Braille READER'S DIGEST represents in its contents the type of Grade 2 materials which blind students most frequently read. The mean rate for the tests in READER'S DIGEST materials was 75.7 words per minute. The standard deviation of — 4.175 indicates that 68 percent of the cases lie between 71.5 and 79.88 words per minute; 95 percent, between 77.35 and 84.

The chances are 68 in 100 that in similar school tests in the READER'S DIGEST with pupils of comparable ages and grades, the mean rate of reading will vary between 75.1 and 75.3; the chances are 95 in 100 that it will fall between 74.5 and 76.9; 99.7 in 100, between 73.9 and 77.5.

Combining all Grade 2 tests, we find a mean of 61.75. The standard deviation of 4.35 indicates that 68 percent of the cases lie between 57.4 and 66.1; 95 percent, between 53.0 and 70.4.

The standard error of the mean of 0.444, indicates that, in test situations of which this data is a representative sampling, the chances are 68 in 100, the true mean will fall between 61.3 and 62.2; 95 in 100, between 60.86 and 62.64; 99.7 chances in 100, it will fall between 60.42 and 63.1 words per minute.

TABLE 15

RATE OF READING TEXTBOOKS IN
STANDARD ENGLISH BRAILLE

CALCULATION OF MEAN, STANDARD DEVIATION,
AND STANDARD ERROR OF THE MEAN

Scores	x'	$(x')^2$
66	66	4356
56	56	3136
43	43	1849
50	50	2500
54	54	2916
49	49	2401
52	52	2704
36	36	1296
41	41	1681
40	40	1600
84	84	7056
54	54	2916
190	190	36100
197	197	38809
	1012	109330

$$N = 14$$

$$AM = 0$$

$$M = \frac{1012}{14} = 72.29$$

$$c = 72.29$$

$$c^2 = 5225.84$$

$$SD = \sqrt{\frac{109,330}{14} - 5225.84} = \sqrt{7809.29 - 5225.84} = \sqrt{2583.45} = 59.14$$

$$SEm = \frac{59.13475}{3.742} = 15.8$$

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TABLE 16

NEW YORK READING PROGRESS TESTS, GRADES 7-9, STANDARD ENGLISH BRAILLE

CALCULATION OF MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN

Interval	Mid-Point	f	x′	fx		fx²
11-15		2	—3	—6		18
16-20		3	2	6		12
21-25		7	—1	—7	(—19)	7
26-30	28	8	0	0		
31-35		5	+1	+5		5
36-40		2	2	4		8
41-45		1	3	3		9
46-50		3	4	12		48
51-55		1	5	5		25
56-60		1	6	6		36
61-65		0	7	0		0
66-70		0	8	0		0
71-75		1	+9	+9	(+35)	81
	N = 34			—19		251
				+16		

$$AM = 28.00$$
$$ci = \underline{2.35}$$
$$Mean \quad 30.35$$

$$c = \frac{16}{34} = 0.47$$
$$i = 5$$
$$ci = 0.47 \times 5 = 2.35$$

$$SD = \sqrt{\frac{251}{34} - 1.1045} = \sqrt{7.3823 - 1.1045} = \sqrt{6.2778} = 2.5037$$

$$SEm = \frac{SD}{\sqrt{n}} = \frac{2.537}{5.831} = 0.435$$

TABLE 17

RATE OF READING THE READER'S DIGEST, GRADES 9-11, STANDARD ENGLISH BRAILLE

CALCULATION OF MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN

Step Intervals	Mid-Point	f	x	fx		fx^2
11- 20		1	—4	—4		16
21- 30		2	3	6		18
31- 40		4	2	8		16
41- 50		9	—1	—9	(—27)	9
51- 60	(53)	6	0	0		
61- 70		6	+1	+6		6
71- 80		2	2	4		8
81- 90		4	3	12		36
91-100		1	4	4		16
101-110		1	5	5		25
111-120		4	6	24		144
121-130		1	7	7		49
131-140		2	8	16		128
141-150		1	9	9		81
151-160		0	10	0		0
161-170		1	11	11		121
171-180		2	12	24		288
181-190		0	13	0		0
191-200		1	+14	+14	(+136)	196

$$N = 48 \qquad \begin{array}{l} +136 \\ -27 \\ \hline +109 \end{array} \qquad 1157$$

$$AM = 53. \qquad\qquad c = +\ \frac{109}{48} = 2.27$$
$$\underline{22.}$$
$$Mean = 75.7 \qquad\qquad ci = 2.27 \times 10 = 22.7$$

$$SD = \sqrt{\frac{1157}{48} - 5.1529 \times 10} = \sqrt{24.10 - 51.53}$$

$$SD = \sqrt{-17.43} = -4.1746$$

$$SEm = \frac{SD}{\sqrt{n}} = \frac{-4.1746}{6.928} = -0.602$$

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TABLE 18

ALL STANDARD ENGLISH BRAILLE TESTS

CALCULATION OF MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN

Interval	Mid-Point	f	x	fx		fx^2
11- 20		6	—5	—30		150
21- 30		17	4	68		272
31- 40		13	3	39		117
41- 50	(45.5)	17	2	34		68
51- 60	(55.5)	12	—1	—12	(—183)	12
61- 70	(65.5)	7	0	0	+150	
71- 80						
81- 90		4	+1	+4	— 33	4
91-100		4	2	8		16
101-110		1	3	3		9
111-120		1	4	4		16
121-130		4	5	20		100
131-140		1	6	6		36
141-150		2	7	14		98
151-160		1	8	8		64
161-170		0	9	0		0
171-180		1	10	10		100
181-190		2	11	22		242
191-200		1	12	12		144
		2	+13	39		507
	N = 96			+150		1955

$$AM = 65.50$$
$$c = -\;3.75$$
$$\overline{}$$
$$61.75$$

$$c = -\frac{33}{96} = -.375$$
$$ci = cx10 = -3.75$$

$$SD = \sqrt{\frac{1955}{96} - 1.40625} = \sqrt{20.364 - 1.406} = \sqrt{18.958} = 4.354$$

$$SEm = \frac{4.354}{\sqrt{96}} = \frac{4.354}{9.798} = 0.444$$

TABLE 19

RATE OF READING STANDARD ENGLISH BRAILLE

THREE TYPES OF MATERIAL COMPARED
AS TO CENTRAL TENDENCIES

Measures	Type of Material			
	Textbooks in Braille 2	Readers Digest	N. Y. Reading Progress Test	All Materials Combined
School Grades	10 and 12	9 and 11	7, 8, 9	9-12
Age Range	16-18	15-20	13-18	13-20
Number of Cases	14	48	34	96
Range Words per Minute	36-197	14-196	13-72	13-197
Mean Words per Minute	72.29	75.7	30.35	61.75
Standard Deviation	59.14	—4.175	2.50	4.354
Standard Error of the Mean	15.8	—0.60	0.435	0.444

PART II

SIGNIFICANT FACTORS AFFECTING
THE RATE OF READING BRAILLE*

There have been very few studies on the factors affecting the rate of braille reading. These factors can be summarized under the following headings: physical factors inherent in the raised point system, psychological factors common to both blind and sighted, psychophysical factors inherent in the techniques used by braille readers, and psychophysical factors arising from the presence of blindness.

This investigation is concerned with the rate of reading braille in relation to such factors common to both blind and sighted as age, intelligence quotient, comprehension of matter read, and years of practice in reading, and to such factors as are peculiar to the blind alone, proportion of life blind. The variability in the mean rates of reading braille in different categories of the above variables will be analyzed in relation to the total mean for the group in rate of reading. The aim is to discover whether there are significant variations from the total mean for the means of different groupings of the variables.

The general purpose is to discover if there are variations in the rate of reading in relation to these factors. The specific variables which are significantly or not significantly associated with speed or slowness in reading will be analyzed. Such factors as the common time element in age, in practice in reading braille, and in the intelligence quotient will be held constant while the rate of reading will be analyzed without their confusing effects. This will give more fundamental information than just whether there is, or is not, a significant variation.

A group of 100 blind students of The New York Institute were used in this study. They were evenly divided as to sex. In age they ranged from 9 to 20 with the majority between 12 and 16. In school grade they ranged from the 4th to the 12th grade with approximately the same number of students in each grade. All of the students were blind as defined by the New York State Education Law. Actually the students ranged in vision from those with no light perception to those who could see objects or movements slightly.

*This section was prepared by George Lavos, M.A.

The instrument used to study the rate of reading was Monroe's Silent Reading Test as adapted for the blind. The test was administered in accordance with the standardization for sighted.

The variables which will be analyzed in relation to the rate of reading as obtained on this instrument are grade, years of practice in reading braille, age, comprehension of material read, intelligence quotient and proportion of life blind.*

To discover the statistical significance of the variation in the mean rates of reading for the different categories of the variables the analysis of variance technique was used.†

RESULTS

The data in Tables I to VI present the means in rate of reading braille for the different variables. Table VII presents data showing the tests of significance applied to the means in Tables I to VI.

The mean rate of words read per minute for the group as a whole was 46.2. There is considerable variation in the means of each of the categories of the variables from this total mean.

The graphs show the variation in means for various categories of the variables. The data in Tables I to VI present the statistics upon which these are based.

By Grade

The means in rate of reading braille by grade are presented in Table I. The mean rate of reading rises at the close of elementary school grades (grades 6 to 8) and falls sharply again in the high school grades. This variation in means for the different grades is statistically significant (Table VII). The chances are considerably less than 1 in 100 that the variation as observed has arisen by chance.

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*A proportion rather than an absolute number of years was used because it includes the two important variables, age and years blind, in relation to each other. A boy blind six years and six years old is different in his blindness from a boy blind six years but sixteen years old.

†For an explanation of this technique see Lindquist, E. F., *Statistical Analysis in Educational Research*, Houghton Mifflin, 1940, Chapter V.

Grade	Mean	Grade	Mean
4	36.8	9	35.1
5	39.2	10	37.9
6	60.4	11	33.2
7	69.7	12	36.2
8	69.9		

By Years of Reading Braille

The information on the variation in mean rate of reading by the number of years braille has been read is presented in Table II. There is, in general, an even rise in the mean rate with increases in the number of years braille has been read. Practice seems to reach a maximum at 8 years. There is a slight decrease and leveling off from 9 to 14 years. This variation is again statistically significant. The probability is less than 1 in 100 chances that this variation as presented has arisen through the interplay of chance factors. We can, therefore, safely reject any hypothesis that the variation is a chance variation.

TABLE II: *Mean rate of reading braille by years of practice.*

Years of Reading Braille	Mean
0-2	36.4
3-5	46.6
6-8	53.0
9-11	39.8
12-14	45.0

By Age

The data on years of age in relation to rate is presented in Table III. As with years of practice there is a rise, and then a decrease. The decrease goes below the mean of the youngest age group. This variation is not statistically reliable. The chances are about 5 in 100 that the variation is due to chance factors.

TABLE III: *Mean rate of reading braille by age.*

Age	Mean	Age	Mean
9-10	44.3	15-16	50.4
11-12	43.2	17-18	40.7
13-14	57.4	19-20	33.0

By Comprehension

The data on comprehension are in Table IV. There is a general rise in the mean with increases in the score on the comprehension of the material. After a score of 17 in comprehension there is a drop and a leveling off until the higher scores are reached. This variation in the mean rate grouped according to the score on the comprehension of the material read is statistically significant.

TABLE IV: *Mean rate of reading braille by comprehension.*

Comprehension Score	Mean	Comprehension Score	Mean
1-4	29.8	21-24	41.3
5-8	46.2	25-28	45.0
9-12	57.0	29-31	51.0
13-16	65.4	32-35	67.0
17-20	34.0		

By Intelligence Quotient

The information on intelligence quotient in relation to rate of reading is tabulated in Table V. There is a consistent rise in speed of reading with increases in intelligence. The statistical significance of this variation, though, is not clear cut. The probability that such a variation as was found here could arise by chance is between 1 and 5 chances in 100. Only further studies can establish whether this rise is significant or not.

TABLE V: *Mean rate of reading braille by intelligence quotient.*

Intelligence Quotient	Mean	Intelligence Quotient	Mean
66-79	42.8	122-135	57.5
80-93	41.3	136-149	56.4
94-107	41.0	150-163	56.0
108-121	47.1	164-up	91.0

By Proportion of Life Blind

The variation in the mean rates of reading braille for different proportions of life spent in blindness is presented in Table VI. This variation shows considerable fluctuation. This variation is not statistically significant according to the test applied. The chances are more than 5 in 100 that a variation such as the one obtained could arise by chance factors.

GRAPH I. Mean Rate of Reading by Grades

	x	x	x	x	x	x	x	x	x
Grades	4	5	6	7	8	9	10	11	12
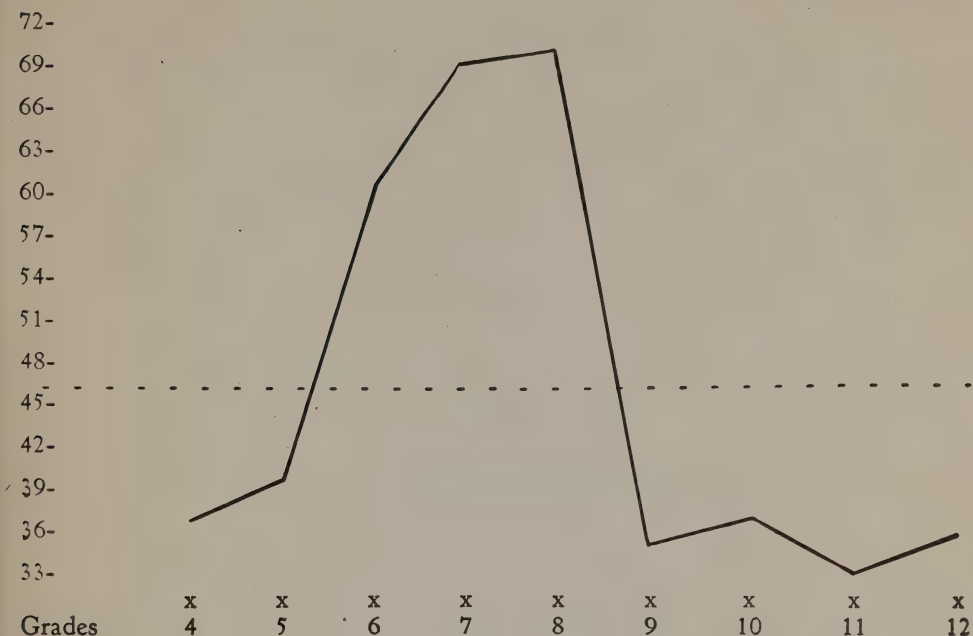
GRAPH II. Mean Rate by Years of Practice
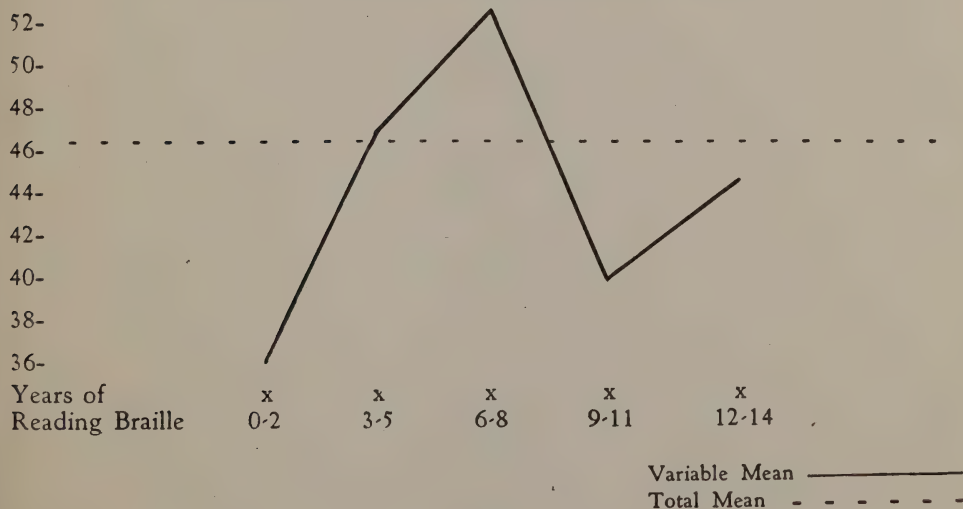
	x	x	x	x	x
Years of Reading Braille	0-2	3-5	6-8	9-11	12-14

Variable Mean ———————

Total Mean - - - - - -

GRAPH III. Mean Rate of Reading Braille by Age

57-
54-
51-
48-
45- -
42-
39-
36-
33-

	x	x	x	x	x	x
Age	9-10	11-12	13-14	15-16	17-18	19-20

GRAPH IV. Mean Rate of Reading Braille by Comprehension

68-
65-
62-
59-
56-
53-
50-
47- -
44-
41-
38-
35-
32-
29-

	x	x	x	x	x	x	x	x	x
Score	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-31	32-35

Variable Mean ————————
Total Mean - - - - - - -

32

GRAPH V. Mean Rate of Reading Braille by Intelligence Quotient

91-							
87-							
83-							
79-							
75-							
71-							
67-							
63-							
59-							
55-							
51-							
47-							
43-							
39-							

I. Q. 66-79 80-93 94-107 108-121 122-135 136-149 150-163 164-up

GRAPH VI. Mean Rate of Reading Braille by Proportion of Life Blind

62-						
59-						
56-						
53-						
50-						
47-						
44-						
41-						
38-						
35-						
32-						
29-						

% Life Blind 100-91 90-81 80-71 70-61 60-51 50-41 20-11

Variable Mean ————
Total Mean - - - - -

33
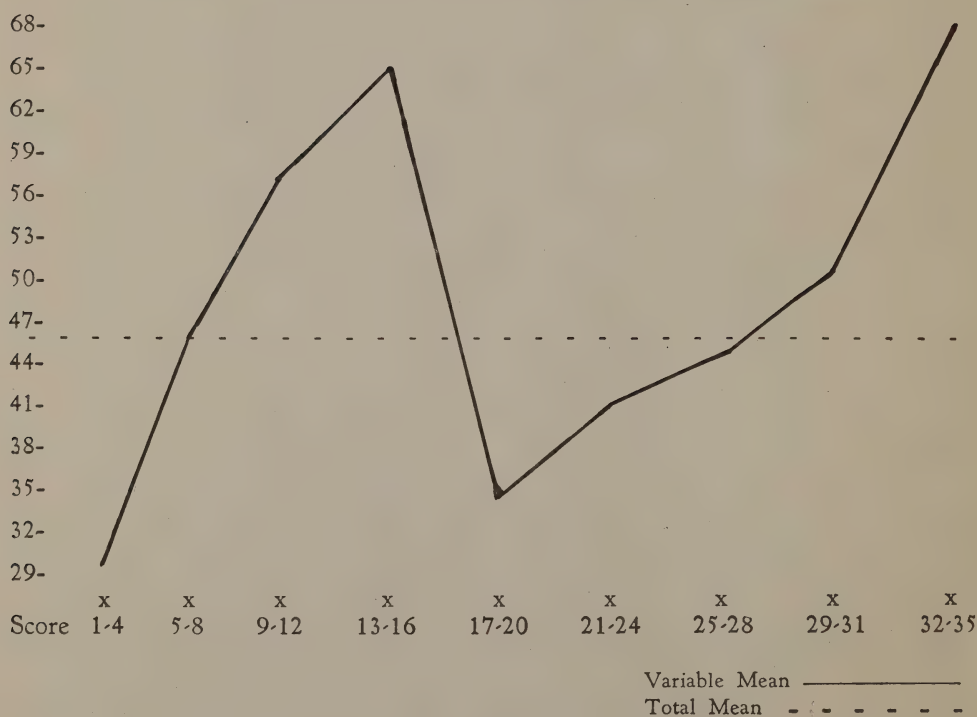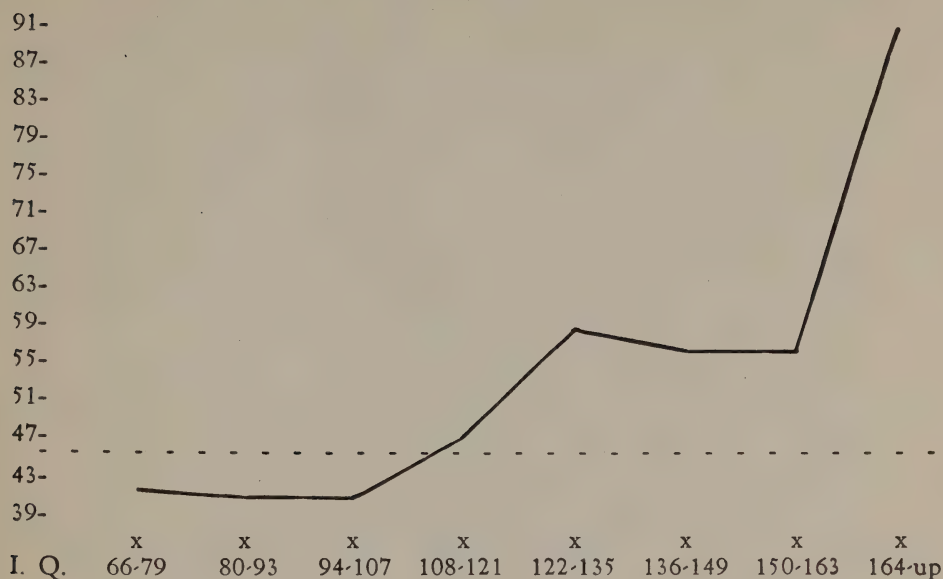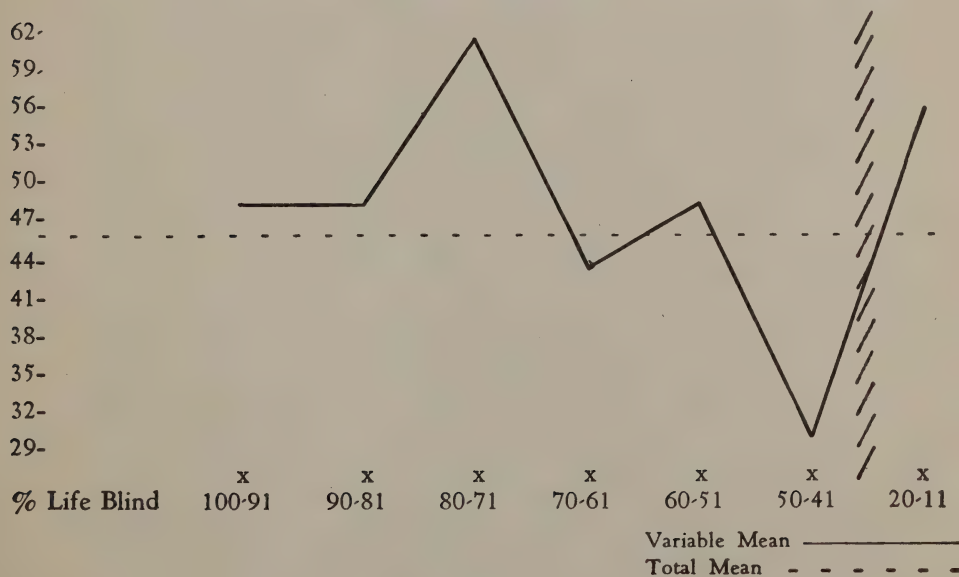
TABLE VI: *Mean rate of reading braille by proportion of life blind.*

100-91%	48.3	60-51%	48.9
90-81%	48.3	50-41%	30.5
80-71%	61.3	—	—
70-61%	43.1	20-11%	56.0

Tests of Significance

There is considerable variation in the means of each of the categories of the variables from the mean for the group as a whole, of 46.2. The variation per se, though, is not important. The variation in relation to the tests of significance shows the importance and reliability which characterize the variations from the total mean.

The variation of the means in the various categories of the variables, ages, and proportion of life blind are not statistically significant. The variations among the means in relation to the total mean can arise upon a basis of chance. It must be pointed out with regard to these two factors that proportion of life blind is dependent on age. Age is common to both variables. The F's or variances are less than the F's which denote the 5 point level.* The chances are therefore more than 5 in 100 that these F's can arise by chance sampling. Since the variations can arise by chance the hypothesis that factors other than chance sampling are at work here is ruled out.

The F for the intelligence quotient lies between the 1 and 5 point level. The chances are therefore more than 1 in 100 and less than 5 in 100 that this F is significant. In as much as the F is in this intermediate point final decison of its significance must be held in abeyance until additional samples of the same population are studied. Grade, years of reading braille or practice and comprehension of matter read have a variation in means from the total group mean which can be considered significant from a statistical viewpoint. The F's of these variables are all above the 1 point level. The chances are, therefore, less than 1 in 100 that such variation as exists in the means from the total mean is due to chance sampling. With such a low probability it can be assumed that the variation is due to factors other than chance sampling. It can be assumed that the variation is due to real factors at work.

It was found that the variations of the rate of reading braille in the means of the variables, grade,—years of braille reading and

*For an explanation of the "F" Test, see Lindquist, E. F., *Statistical Analysis in Education Research,* pp. 56-66.

comprehension—are statistically significant. From Grades 5 to 8 there is a steady rise in the mean rate. This may be due to the emphasis placed on preparation for the first state examinations in high school subjects which occur at the end of the 8th grade. The high school grades show a tapering off as the emphasis is placed heavily on topics and comprehension of subject matter. Years of reading braille probably follows the same trend as grade means because years of reading braille are dependent on the grade.

Comprehension shows, in general, a rise with a rise in the speed of reading. There is a fall, though, in the middle ranges of the comprehension scores. No hypothesis will be advanced to explain the variation. The steady rise which characterizes the graph as a whole can be expected. High comprehension in reading and speed of reading are positively related through the common intelligence factor.

TABLE VII: *Tests of significance of variation among the means in comparison with the mean for the entire group.*

Variable	F	F_1	F_5
Age	2.27	3.20	2.30
Grade	13.40	2.69	2.03
Years braille read	16.50	3.51	2.46
Comprehension	3.05	2.69	2.03
Intelligence quotient	2.43	2.82	2.10
Proportion of life blind	1.53	2.99	2.10

Conclusions

The data as presented thus far show certain tendencies. There is variation in the means for different categories of the variables analyzed. The statistical tests applied to the variations in the means for different groups of the variables have shown that the chances that some of the variations could occur solely by chance factors are less than 1 in 100. Statisticians are agreed that it is reasonable to accept such variations as real.

The variations in the means of the groupings of grades, years of practice in reading braille, and comprehension of matter read, from the total mean for the group as a whole are statistically significant.

The variations in the means for age and proportion of life blind are not significant. Chance can account for the variation.

The significance of the variation according to I.Q. cannot be decided upon the present data. The result, being between the two levels of significance, is equivocal.

PART III

TESTS IN THE ORAL READING OF BRAILLE*

Pupils in all classes of the Upper School were tested individually in the oral reading of braille. Emphasis was placed upon speed, with some consideration given to accuracy, attitude toward reading, etc. 135 pupils were tested during a period extending from October 7 to December 18, 1941.

Besides some special pupils who brought their own reading material with them, the group was divided into three definite groups, based on the test material. For each test the pupil was permitted to read for five minutes, since any less time than this would seem inadequate for a fair judgment of speed. There seemed to be no standardized tests of sufficient length available in braille, and therefore selections were chosen by the tester from regular reading textbooks. It might have seemed better to give the Sixth Grade pupils reading material of the Fifth Grade level or even lower, for testing oral "sight" reading. However, without resorting to further transcribing, there is no material available under the Eighth Grade or High School level in Braille 2.

It was impossible to list the inaccuracies in punctuation, pronunciation, etc., of each pupil. In the brief summaries of each test given, only inaccuracies most frequently made were listed.

SIXTH GRADE: The selection chosen is found in the SIXTH READER of THE LITERARY WORLD, Volume III, page 300, of the Braille Edition. The selection is entitled THE GREAT STORM, and the test started with the paragraph beginning with, "Not a flake of snow had fallen . . ." by Richard D. Blackmore. (NOTE:—The words in each selection used for testing were counted one by one, without regard to length, or to the proportionate number on the line. Hyphenated words were counted as two words.)

SEVENTH GRADE: Test material used was the SEVENTH READER of THE LITERARY WORLD series. From Volume I, page 5, of the Braille Edition, RIP VAN WINKLE was chosen.

*Contributed by Mrs. Hartley Campbell, *nee* Dorothy J. Nelson.

EIGHTH GRADE AND HIGH SCHOOL: By the time pupils are in the Eighth Grade, they have usually completed the Regents examination in reading. Also, it seemed fair to give the same test in reading of Standard English Braille, to each member of this group. This grade had used CHOICE READINGS, edited by Robert McLean Cumnock, and copyright in 1923, by M. C. McClurg and Company. From this book was chosen THE STRENUOUS LIFE, by Theodore Roosevelt, Vol. VI, page 483, of the Braille Edition.

The selection used for the test in the reading of Standard English Braille was taken from YOU CAN LEARN TO READ BRAILLE, by Madeleine Seymour Loomis. The selection is to be found in Vol. II, page 149, of the Braille Edition, and is entitled THESE MEN MAKE OUR WORLD, by Merle Thorpe, as condensed in THE READER'S DIGEST, from THE COMMENTATOR.

TABLE 1

SUMMARY OF TESTS IN THE ORAL READING OF BRAILLE

Table showing average number of words per minute in oral reading of Braille.

By School Grade

School Grade	6	7	8	9	10	11	12	P.G.
Braille 1½	56.5	55.8	53.5	72.5	77.7	55.2	84	87.3
Braille 2			47.3	67	73.6			

By Years Reading Braille

Years	1	2	3	4	5	6	7	8	9	10	11
Braille 1½	22.9	46.5	57.6	66.6	76.6	46.6	95.5	84.8	69.7	99.7	39
Braille 2		48.4		41.7	60.1	40.8	89.9	76.1	42.4	90.7	27.8

PART IV

SUMMARY OF STUDIES IN THE RATE OF READING BRAILLE

The average speed of reading braille is difficult to ascertain ac-curately because there are so many different kinds of readers, and several different grades of Braille. The rates will differ also for silent and oral reading.

The results of our tests show some interesting facts about the reading of our children.

The congenitally blind who learn braille in childhood, are gener-ally the speediest readers. Blind school children can read Braille, Grade 1½, as fast as 196 words per minute; and at an average of sixty-five words per minute in silent reading. (The elderly blind, if they learn braille, usually learn Grade 1; studies with this group have revealed a reading rate of from 34 to 79 words per minute.*)

The average blind child in school has a silent reading average, in Braille 1½, of 65 words per minute; in Braille 2, of 61 words per minute. A few experienced readers can cover 196 words per minute with their fingers. According to leading authorities, eighth grade school children read from 240-293 words a minute, with an average of 288. (See the accompanying table of Sighted Reading Norms.)

At an average of 60-65 words per minute, blind pupils read from one-fifth to one-fourth as fast as the sighted.

In a half-hour study period, the average blind student was found to read, in high-school textbooks, 10-12.5 pages.

Tests using the READER'S DIGEST, which is in Braille 2, indicate that blind school children read from one-tenth to one-third as fast as the sighted, in this medium. The range of words per minute was from 14-196, with an average of 75. If we take the average for comparison, we conclude that the blind read about one-fourth as fast as the sighted in the READER'S DIGEST.

*See Burklen, Karl, *Touch Reading of the Blind,* American Foundation for the Blind, New York, 1932.

The following Summary of the results of these tests is presented as a statement of facts which may prove useful to teachers and administrators wishing some basis of comparison for judging how fast their pupils should be reading braille. To facilitate this purpose, the table of smoothed means has been prepared showing the probable averages for each school grade, and for each year of experience in reading braille, in school situations in which this test data is representative. These figures are not presented as norms, but simply as facts to guide the study of comparable school situations. The table of Sighted Reading Norms has been prepared for this purpose also.

"In selecting a reading norm, the teacher should note the general character of the reading material used for any test—vocabulary, length of sentences, familiarity of the material, etc. Use the norm based on material which is nearest like other material used in your grade." (*Michigan State Normal Teaching Guide in Reading.*)

GENERAL SUMMARY

TABLE 1

RATE OF READING BRAILLE 1½, BY WORDS PER MINUTE

By Number of Years Reading Braille

TEST	1	2	3	4	5	6	7	8	9	10	11	12	ALL
Means N. Y. Institute Tests	35.7	57.3	54.2	57.3	63.3	82.4	77.8	65.5	71.7	89.9	60.7	100.5	65.2
Number of Cases	16	14	48	53	48	32	32	20	25	13	11	2	336
Courtis-Means Overbrook (1917)	24	56	36	49	55	64	68	74	76	102	87	89	

By School Grades

TEST	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Means N. Y. Institute Tests		47	62	49.2	51.0	66.5	90.1	79.2	43.2	71.7	95	63.8
Number of Cases		5	7	42	53	56	34	38	28	33	12	32
Courtis-Means Overbrook (1917)	30	42	60	56	72	59	82	79	83			
Niday Survey (1938) (Median Scores				42.7	53.5	74.2	75.8	81.6	37.4	37.8	39.1	38.7

TABLE 2

RATE OF READING STANDARD ENGLISH BRAILLE

By Number of Years Reading Braille

	1	2	3	4	5	6	7	8	9	10	11	12	ALL
Mean Words per Minute	26	33.5	29	87.7	39.8	30.2	46.7	74.8	73.5	66.9	82.9	196	61.75
Number of Cases	3	4	5	4	7	10	13	15	12	11	11	1	96

By School Grades

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Mean Words per Minute							30.4	24.5	49.9	113.6	79.7	50.2
Number of Cases							13	10	36	5	32	5

TABLE 3

TABLE OF SMOOTHED MEANS
SHOWING RATE OF READING BRAILLE 1½ AND 2 IN WORDS PER MINUTE, BASED ON TESTS AT THE NEW YORK INSTITUTE

By Number of Years Reading Braille

	1	2	3	4	5	6	7	8	9	10	11	12
Braille Grade 1½	34.7	45.4	54.4	60.2	66.6	72.3	73.9	75.3	74.6	77.8	81.6	85.9
Braille Grade 2	15.3	32.0	45.0	52.8	49.4	46.3	50.3	61.0	70.1	76.1	83.4	89.5

By School Grades

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Braille Grade 1½	42.9	50.2	54.0	59.9	67.7	72.8	71.3	68.4	70.4	73.6	75.0	
Braille Grade 2							30.6	41.9	66.1	86.2	107.0	121.6

TABLE 4

SIGHTED SPEED OF SILENT READING NORMS
Words Per Minute

Grades	Starch	Gray	Courtis	O'Brien	Oberholtzer	Averages
II	108	90	84	....	....	94
III	126	138	113	....	....	126
IV	144	180	145	236	156	172
V	168	204	168	278	186	201
VI	192	216	191	293	234	225
VII	216	228	250	322	282	259
VIII	240	240	280	393	288	288

Starch: Educational Psychology 1922. Macmillan.
Gray: Studies of Elementary School Reading. Through Standardized Tests 1917. U. of Chicago Press.
Courtis: Standard Research Tests in Silent Reading. S. A. Courtis, Detroit.
O'Brien: Silent Reading, 1922, Macmillan.
Oberholtzer: Course of Study in Reading, Michigan State Normal School.